Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
FHWA/TX-10/0-6608-3		

4. Title and Subtitle	5. Report Date
INTEGRATING THE TRANSPORTATION SYSTEM WITH A UNIVERSITY TRANSPORTATION MASTER PLAN: BEST PRACTICES AND LESSONS LEARNED	February 2010 Published: May 2010
	6. Performing Organization Code

7. Author(s)	8. Performing Organization Report No.
Rafael Aldrete-Sanchez, Jeffrey Shelton, and Ruey (Kelvin) Cheu	Report 0-6608-3

9. Performing Organization Name and Address	10. Work Unit No. (TRAIS)
Texas Transportation Institute The Texas A&M University System College Station, Texas 77843-3135	11. Contract or Grant No. Project 0-6608

12. Sponsoring Agency Name and Address	13. Type of Report and Period Covered
Texas Department of Transportation Research and Technology Implementation Office P.O. Box 5080 Austin, Texas 78763-5080	Technical Report: May 2009 – September 2009
	14. Sponsoring Agency Code

15. Supplementary Notes

Project performed in cooperation with the Texas Department of Transportation and the Federal Highway Administration.
Project Title: Integrating the Transportation System with a University Transportation Master Plan
URL: http://tti.tamu.edu/documents/0-6608-3.pdf

16. Abstract

The University of Texas at El Paso (UTEP) is planning several projects that will have a substantial impact in the transportation network in El Paso. This research project conducted a study of the integration of the El Paso metropolitan transportation system with UTEP's transportation master plan and to develop a synthesis of best practices of transportation systems integration employed by universities from across the country. This research report presents a synthesis of these best practices and documents the lessons learned during the analysis of the UTEP campus found in Report 0-6608-2. The overall goal of the report was to provide guidance on the integration between transportation systems and a university campus master plan. Researchers used a two-pronged approach to document best practices in this report. First, researchers conducted a review of the state-of-the-practice on university campuses around the country. Second, researchers synthesized the lessons learned from the development of the case study analysis of the UTEP campus master plan and its integration with current and planned metropolitan transportation infrastructure, where the integrated application of practices from around the country could be tested.

17. Key Words	18. Distribution Statement
University Campus Master Plan, Transportation System, Pedestrian Safety, Transportation System Integration, Best Practices.	No restrictions. This document is available to the public through NTIS: National Technical Information Service Springfield, Virginia 22161 http://www.ntis.gov

19. Security Classif.(of this report)	20. Security Classif.(of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	24	

Form DOT F 1700.7 (8-72) Reproduction of completed page authorized

INTEGRATING THE TRANSPORTATION SYSTEM WITH A UNIVERSITY TRANSPORTATION MASTER PLAN: BEST PRACTICES AND LESSONS LEARNED

by

Rafael Aldrete-Sanchez, Ph.D.
Research Scientist
Texas Transportation Institute

Jeffrey Shelton
Assistant Research Scientist
Texas Transportation Institute

and

Ruey (Kelvin) Cheu, Ph.D., P.E.
Associate Professor, Dept. of Civil Engineering
The University of Texas at El Paso

Report 0-6608-3
Project 0-6608
Project Title: Integrating the Transportation System with a University Transportation Master Plan

Performed in cooperation with the
Texas Department of Transportation
and the
Federal Highway Administration

February 2010
Published: May 2010

TEXAS TRANSPORTATION INSTITUTE
The Texas A&M University System
College Station, Texas 77843-3135

DISCLAIMER

This research was performed in cooperation with the Texas Department of Transportation (TxDOT) and the Federal Highway Administration (FHWA). The contents of this report reflect the views of the authors, who are responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official view or policies of the FHWA or TxDOT. This report does not constitute a standard, specification, or regulation.

ACKNOWLEDGMENTS

This project was conducted in cooperation with TxDOT and FHWA.

The project team thanks Lonnie Gregorcyk, district engineer in the TxDOT Yoakum District, and Chuck Berry, district engineer in the TxDOT El Paso District for their guidance and support. Thanks also go to staff at both the University of Texas at El Paso (UTEP) and TTI for the diligent effort put in on this project.

TABLE OF CONTENTS

Page

PROJECT BACKGROUND

The University of Texas at El Paso (UTEP) is planning several projects that will have a substantial impact on the transportation network in El Paso. Consequently, the Texas Department of Transportation (TxDOT) has requested the assistance from the Texas Transportation Institute (TTI) to perform a study of the integration of the transportation system with UTEP's transportation master plan and to develop a synthesis of best practices of transportation systems integration employed by universities from across the country.

This research report presents a synthesis of best practices and documents the lessons learned during the analysis of the UTEP campus described in Report 0-6608-2 (Task 10). The overall goal of the report was to provide guidance on the integration between transportation systems and a university campus master plan. The results of this research will have a near-term applicability for TxDOT, particularly in urban areas where there are highly dense university campus populations.

In order to conduct the technical evaluation the research team proposed the following nine steps:

1. Conduct Literature Review (Task 2)
2. Review Accident Locations (Task 3)
3. Develop and Perform Faculty, Staff and Student Surveys (Task 4)
4. Characterize Current and Future systems (Task 5)
5. Identify Gaps and Develop Scenarios (Task 6)
6. Analyze Transportation System Integration and Interactions (Task 7)
7. Estimate Costs (Task 8)
8. Case Study Conclusions and Recommendations (Task 9)
9. Synthesize Best Practices and Lessons Learned (Task 10)

TASK 10: SYNTHESIZE BEST PRACTICES AND LESSONS LEARNED

The transportation system within and around a university campus is a critical component for mobility. University transportation systems are considered major trip attractors, with thousands of students, faculty and staff arriving and departing on a daily basis and extremely heavy congestion periods during morning peak hours. This intense level of activity generates significant congestion within the campuses and the immediate perimeter. With university trends expected to increase enrollment substantially over the next decade, the congestion problems many campuses face can only be expected to worsen. As the population keeps growing, the already troubled transportation system will face an enormous demand; particularly the freeway systems and surrounding arterials in proximity to universities.

In addition, university campus settings are multi-modal and complex in nature, incorporating vehicular traffic, transit, and pedestrians into one transportation system. This creates a significant challenge for university campus planners when trying to incorporate their future master plan into the overall regional or metropolitan transportation system. Review of literature shows that there is limited documentation on the various interactions of transportation modes (auto, transit, bicycle, and pedestrian) within a campus setting. Additionally, there is no documentation of a systemic integration of these different modes with the larger transportation system.

The mix of concentrated levels of pedestrian and bicycle traffic with vehicular congestion in a campus setting creates a number of significant conflict areas that range from pedestrian and cyclist safety to traffic and transit operations. These conflicts are exacerbated by the multi-jurisdictional nature of these interactions, which involve authorities at the campus, city, and state levels. The practice of integrating transportation systems with university campus master plans offers efficient, sustainable approaches to improve pedestrian and bicyclist safety; convenient and efficient access to the university campus and surrounding neighborhoods; and enhanced attractiveness and character of the community. More specifically, integrated transportation systems allow planners at the university, city, and state levels to achieve several major goals including collaborative planning, pedestrian and bicycle safety, use of public transit, parking, and

motorized vehicle traffic. The synthesis of best practices outlined in this report is categorized into two distinct sections, (1) best practices and (2) lessons learned. The *best practices* section presents a compilation of recommendations from universities across the country for integrating the surrounding transportation system with a university campus master plan. The *lessons learned* section outlines practical considerations that must be taken into account when trying to implement best practices on different campuses.

OBJECTIVE AND METHODOLOGY

The objective of Task 10 was to develop and document a synthesis of best practices employed by universities across the country with emphasis on pedestrian safety solutions. The results of this task can be utilized by universities and all external agencies that provide or support the surrounding transportation system. Findings from the UTEP case study (see Case Study Research Report 0-6608-2) play a key role in supplementing guidelines on existing practices across the country by providing real-world applications for transportation integration and pedestrian safety.

Researchers used a two-pronged approach to ultimately outline and document best practices. First, researchers conducted a review of the state-of-the-practice on university campuses around the country. Second, researchers conducted a case study analysis of the UTEP campus master plan and its integration with current and planned metropolitan transportation infrastructure, where the integrated application of practices from around the country could be tested.

The review of the state-of-the-practice revealed that practices at university campuses across the country were at various stages of development; therefore, researchers classified these practices into three different stages of development:

- least advanced;
- moderately advanced; and
- most advanced.

These stages are described in detail in the Case Study Research Report. In classifying practices at campuses from around the country into these stages of development, researchers considered several factors such as perceptual effectiveness, representativeness of technology trends, consistency with contemporary transportation developments, and applicability on other campuses. In many instances individual campuses are able to address their transportation needs in the context of their environment, regardless of their situation in this stage of development classification. Solution strategies to solve congestion, parking, or transit-related issues will undoubtedly vary because of the unique circumstances of every university campus so this guidance may not necessarily apply. For example, one university may simply construct a new parking garage on a less-traveled area of campus to relieve congestion. The additional parking supply would not be considered a best practice. However, if the university provided new bicycle/walk paths, transit service, and more advanced traffic control – this may be considered a best practice if these improvements address and improve any pedestrian and bicycle safety concerns.

BEST PRACTICES

Researchers organized the best practices into six categories. These categories are:

- Collaborative Planning,
- Pedestrian and Bicycle Safety,
- Public Transit,
- Parking,
- Motorized Vehicle Traffic, and
- Long-Term Transportation Planning.

Collaborative Planning

Collaboration among all stakeholders is a critical element when trying to integrate the campus and its external transportation system. Extensive coordination with all affected agencies (e.g., city, county, state DOTs, neighborhood associations) is needed, and input from

stakeholders on most or all transportation topics (including transit, parking, congestion management, and pedestrian and bicycles) is beneficial.

Best practices in this category are summarized below by stakeholder group:

- Regional Planners – Coordination and communication at various levels is needed, starting with regional planners (e.g., metropolitan planning organizations). Regional planners must know far enough in advance what changes or improvements a university wants to pursue. This allows for long-term planning of surrounding infrastructure and possible pursuit of funding resources.

- State DOTs – Oftentimes, universities sit adjacent to major freeways or highways with daily campus traffic affecting traffic congestion. University officials find it beneficial to have continued communication efforts with state officials to coordinate any future planned infrastructure or operational improvements.

- City Officials – University officials find it in their best interests to keep in close contact with city officials. Cities are usually in charge of arterial and localized streets that can directly impact the university transportation system. City officials can improve local streets by limiting turning movements and optimizing signal timings to improve congestion levels around campus. City officials can construct, improve, or upgrade sidewalks and bicycle paths thus encouraging non-motorized modes of travel to campus and reducing overall congestion. City officials can provide various sources of data including demographics, zoning, and historical information pertaining to land use and land values. City and university officials can work together to determine the best options for parking on local streets around campus and whether "no-parking" areas benefit or hinder overall traffic congestion.

- Transit Officials – University officials can benefit from collective talks with transit officials and request specific (express) transit routes that directly service the university. Campus planners can strike agreements with transit officials to construct transit terminals on campus thus encouraging direct campus access through public transportation and possibly offering student passes (e.g., monthly or semester) at reduced rates.

- Neighborhood Associations – University officials find it in their best interests to communicate with residents that live in neighborhoods surrounding the campus. Residents can provide information regarding parking issues on their streets, and whether congestion hinders their ability to access their property during daily school time periods or special events. Communication allows neighborhoods to voice their opinions on issues regarding quality of public services, adequate infrastructure, and overall safety issues.

Pedestrian and Bicycle Safety

Bicycle and pedestrian traffic are the most common modes of traffic within the inner perimeter of university campuses. Most universities across the country try to develop their campuses as a safe and accessible environment for pedestrians and cyclists. Some universities include policy statements for their campus master plans that clearly rank pedestrian, bicycle, and transit as higher-priority modes of travel on campus compared to individual motor vehicles. Best practices in this category are organized into three groups (campus infrastructure, incentives, and safety) and listed below.

- Campus infrastructure – To deter impedance of pedestrians and bicyclists on campus, universities should improve their walkways and bicycle pathways to provide better accessibility and connectivity between parking lots and classrooms. It is in the university's best interest to accommodate various types of connectivity including crosswalks, sidewalks, median refuge islands, pedestrian bridges, underground pedestrian walkways, and bicycle lanes. For these types of improvements, university officials should first look at locations where there are heavy pedestrian/vehicle interactions to devise a scheme that will accommodate both pedestrians and traffic flow (e.g., crosswalks that have heavy traffic inflow should be altered for a pedestrian bridge or underground walkway to reduce queuing caused by constant pedestrian crossings). These types of solutions need to be designed properly to ensure cost-effectiveness. In addition, adequate sidewalk and bicycle pathways not only improve the overall safety and mobility for pedestrians and bicyclists, but help promote the use of non-motorized transportation in and around campus.

- Incentives – Universities should incorporate pedestrian-friendly facilities on campus such as shaded/sheltered seating, adequate lighting, drinking fountains, sufficient bicycle racks, and covered bicycle parking at major campus buildings.
  - Universities wanting to increase bicycle usage should consider additional incentives including bicycle lockers with showers. In addition, some universities have established a bicycle sharing program that provides free bicycles to students for personal use, public bicycles for student sharing, bicycles that can be rented at little or no cost, or discounted bicycles for purchase.
  - Adequate lighting in poorly lit locations should be considered to promote a safer feel to the campus setting. A recent survey conducted by UTEP asked if students felt unsafe after leaving evening or nighttime classes. Many female respondents felt that adequate lighting in poorly lit areas would entice them to walk or bicycle to school instead of driving (*1*).
  - A heavy police presence on universities provides much-needed assurance and comfort for pedestrians and bicyclists. Police presence gives students comfort when walking or bicycling at night, as it helps reduce the potential for bicycle theft and provide overall pedestrian safety.

- Safety – Most campuses across the country are developed to be pedestrian- and bicycle-friendly environments by restricting motor vehicular traffic and providing infrastructural support and facilities necessary, and therefore the interior campuses are generally safe places. However, campus peripheral areas can be problematic due to risks caused by conflict points between frequent vehicular traffic and pedestrians or cyclists entering or exiting the campus. Some safety strategies can be implemented on campus including:
  - Improved intersection design and roadway geometry to reduce travel speeds, restrict ambient traffic and provide pedestrian refuge (e.g., median islands).
  - Improve traffic control by optimizing signal timings, providing adequate signage, and posting warnings. Signals with red beacons typically have displays with solid or flashing red beacons that include "half signals" midblock signals, and high-intensity activated crosswalks (HAWK) signals. Locations with high-volume and high–speed traffic can benefit from these types of traffic control. Audible or tactile signals may also be included to assist pedestrians who have poor sight. Some universities use signals with countdown timers to give notice to both drivers and pedestrians of the time remaining on the crossing signal. In addition, implementing traffic calming devices (e.g., speed humps, roundabouts, chicanes, rumble strips, dynamic radar signs) will deter speeding in and around campus.
  - Improve safety awareness by establishing educational programs and campaigns that promote the adherence of laws and regulations and use of safety equipment (e.g., helmets, flashers, reflective vests).

Public Transit

Public transit is an important transportation component for most universities in urban settings. Depending on campus size, conditions, and host city transit service availability, universities typically provide their own transit services (e.g., campus shuttle and transfer station) and/or utilize services from host cities. Below are several best practices for universities that employ services with the host city and/or offer services provided by the campus.

- Integrated transit transportation systems are common in many campus settings. Having a city transit service with routes that either transverse through or go around a campus provides access to many faculty and students who do not use motorized modes of transportation. In addition, universities often have inner campus transportation in the form of shuttle buses. These shuttles circulate the perimeter of the campus parking lots (remote parking) and transfer students and staff to inner campus. This is often the case where remote parking is offered at a reduced rate but too far to walk for many. Furthermore, having a public transit terminal located on or adjacent to the university campus provides incentives for students to use public transportation to the campus perimeter and then take the university transit to travel to the inner campus. This reduces overall congestion and emissions, and promotes the use of public transit.

- Some universities offer incentives to encourage students and staff to use transit by offering either free or discounted fares. In addition, it is often recommended that universities have or consider having transit malls and transit hubs at locations with high pedestrian volume to facilitate the use of transit services. Improvements to other transit services and facilities include sheltered stop locations, adequate lighting, and other safety measures. Universities often benefit when offering schedule flexibility (shorter headways) so students and employees can arrive on-time to campus.

- Collaboration of transit services refers to having the host city provide sufficient routes that originate from highly dense locations throughout the city. It is common that universities collaboratively plan and manage transit services on their campuses with host cities in terms of fares, routes, schedule, and terminal locations to maximize serviceability, flexibility, and connectivity. The City of El Paso has external express routes travel from origins directly to the UTEP campus without mid-stop locations, thus reducing delays and providing overall shorter travel time.

- Potential improvement for transit services includes the use of intelligent transportation systems (ITS) by providing advanced traveler information. ITS provides vehicle location and arriving time to riders on a real-time basis where service sometimes increases during peak hours and evenings to better fit student schedules.

Parking

Providing adequate parking for students, faculty, and staff is a major challenge for many university planners. It is one of the most critical components to the campus transportation system and is therefore often addressed separately in campus planning. Effective parking planning and management should consider the needs and challenges of all components of the university transportation system and the surrounding transportation system. Best practices in this category are listed below:

- Extensive collaboration and involvement in parking management within the surrounding neighborhoods should use appropriate methods such as establishing collaboratively managed parking districts. Universities often assign different levels of parking choices based upon distance, location, and cost. Usually, parking in remote lots costs less for an annual pass (sticker) than closer premium lots. University officials can use pricing mechanisms to regulate supply and demand in and around the campus by charging considerably higher prices for parking that is close to the inner campus or is an enclosed setting (e.g., garaged parking).

- Well-designed and managed campus parking facilities should include reliable shuttle service and safety measures (e.g., campus shuttle should have adequate and consistent headways; surrounding infrastructure should include adequate lighting to promote walking).

- ITS should play a role in parking management and include information tools such as advanced parking management systems (e.g., display signs that convey how many parking spaces are still available at any given time) and dynamic message signs to give drivers advanced warning of congestion levels in and around parking facilities. ITS technology can provide advanced traveler information via the internet, television, radio, and cell phone messages. Since visitors traveling to the university campus often do not know where they should park, convenient and clearly guided parking and signage is highly recommended. Campus officials can charge premium rates for visitor parking to deter students and staff from parking in these locations.

- Encourage ridesharing programs on campus where parking stickers are sold at a reduced rate and parking spaces are allocated to locations that are close to the inner campus thus promoting carpooling. University officials may collaborate with rideshare programs to establish long-lasting contracts that entice commuters to avoid single-occupancy vehicle trips. University officials may collaborate with state DOTs to provide high-occupancy vehicle lanes on freeways to further promote carpooling.

- To deter students and employees from parking in surrounding neighborhoods, university planners, city officials, and neighborhood associations should work together to manage and regulate parking. Parking stickers can be issued to neighborhood residents with appropriate signage on streets to deter students from parking in the surrounding areas.

Motorized Vehicle Traffic

Even though many universities allocate tremendous resources to reducing vehicular traffic, motorized vehicles still remain the most common mode of transportation to and from the university campus for university employees and students. Personal vehicles frequently cause extreme traffic congestion, deteriorate safety, and cause parking shortages – especially during morning peak hours. Therefore some campuses apply restrictions to vehicular traffic to discourage personal auto use as a method of travel to campus. Best practices on managing motorized vehicle traffic are listed below.

- A common trend of campus design master plans is to close certain parts of the campus core from pass-through traffic with the goal of creating a more pedestrian-friendly environment that minimizes vehicle-pedestrian conflicts, improving safety for both pedestrians and bicyclists. Campus closed to vehicular traffic should provide sufficient accessibility for emergency vehicles that need to access buildings on the interior of campus.

- Flexible working schedules for non-teaching staff (e.g., maintenance, janitorial), where employees travel to campus during off-peak hours, or use of tele-communication technologies, where either/both faculty and students use web-based

applications and teleconferencing to conduct classes and meetings, provide alternatives to peak-period travel. Scheduling large classes (e.g., freshman history classes) before or after morning peak-hour rush reduces congestion levels – as does scheduling classes at alternative building locations to redistribute traffic to less-congested areas on campus.

- Some universities offer guaranteed ride home programs where the university assures employees and students who commute by alternative modes a ride home during cases of emergencies. Some universities also provide innovative incentives such as campus access fees with rebates for use of alternative modes of transport.

Long-Term University Transportation Planning

Many universities hire private consultants to analyze and project future traffic congestion in and around campus. Traffic details such as lane-change maneuvers cannot be represented at the regional (macroscopic) level. Macroscopic simulation models deal with long-term traffic projections at an aggregated level and therefore cannot simulate the temporal and spatial distribution of traffic, especially during the peak morning hours. These types of models are typically used by planners at MPOs, and are suitable for freeway analyses where merging and lane-changing interactions are not of great importance.

Mesoscopic simulation models normally describe at a lower level of detail than a microscopic model, but have enough fidelity to represent traffic flow during peak and off-peak hours. In addition, mesoscopic models typically run dynamic traffic assignment and can reroute traffic based upon existing traffic congestion. University officials should collaborate with both city and state officials to analyze any infrastructure improvements that will change driver behavior by rerouting to alternative routes. However, the drawback of mesoscopic simulation is that it does not have the granularity to analyze traffic on a lane-by-lane basis. In addition, mesoscopic models often cannot classify multiple vehicle compositions (e.g., student, faculty, staff, and visitor) in addition to other modes of transport including bicyclists and pedestrians. On the other hand, many microscopic models have the ability to analyze various modes of traffic at a detailed level but it is difficult to simulate the surrounding transportation system to determine vehicle rerouting around the campus perimeter.

Hence, the best practice in this category consists of using a multi-resolution simulation assignment modeling approach for operational planning in university campuses as a way to overcome the challenges that macroscopic and microscopic simulation pose.

Mesoscopic models are run to user equilibrium conditions to capture the dynamics of rerouting due to experienced travel time for vehicles. A microscopic model is then used to analyze various modes of transport at finer levels of details. Microscopic simulation can determine the optimal parking given current position, distance from desired final destination, current parking availability, and overall attractiveness. Some of the most significant benefits of this approach include:

- ability to analyze how pedestrians interact with vehicular traffic given several different design alternatives for traffic control (e.g., how pedestrians and vehicles interact at signalized intersections versus a roundabout);
- ability to determine delays and queue lengths due to congestion and experienced travel time given different path alternatives; and
- ability to analyze various design alternatives for infrastructure improvements and provide critical information to assist officials in making cost-effective improvement decisions.

LESSONS LEARNED

In conducting the analysis of the UTEP case study, the research team was able to identify a number of interrelated issues that must be considered when analyzing and planning the integration of the regional transportation system with a university campus transportation system. These issues are primarily related to the way data collection, public surveys, multi-resolution modeling, and crash analysis are conducted. The experience gained in dealing with these issues through the UTEP case study analysis is presented in this section in the form of lessons learned for the benefit of practitioners and researchers. The following sections discuss these lessons learned within the overall system integration process, thus highlighting the need for researchers to carefully consider them throughout the project development process.

Data Collection

Data should be collected during regular campus sessions in order to capture the true dynamics of the various mode interactions in and around campus. Researchers should collect traffic and pedestrian counts during the highest peak periods at all major intersections and access points that surround the campus perimeter. In addition, data should be collected on several different days of the week, as campus schedules differ between days of the week and this is

reflected in overall congestion and traffic patterns. Researchers should perform site investigations of the overall campus infrastructure, documenting all related issues including infrastructure accessibility and condition, parking trends, vehicle-pedestrian conflict areas, neighborhood conditions, lighting, and the overall geometric design of the system.

Crash Analysis

When conducting a crash analysis, researchers should collect crash reports from both university campus and local police departments. When collecting crash data around a university campus, researchers will need to filter out minor "fender-bender" accidents that only require an insurance claim against more severe accidents that may or may not include injuries at different levels. This is necessary to identify localized crash hot-spots that may contribute to the frequency and severity of the accidents. In addition, when collecting crash data from several different resources, researchers must realize that crash data are documented in different ways by different agencies and different individuals. For example, when an accident is reported in the vicinity of a university, street name and location may be classified, categorized, or spelled differently by different individuals. Therefore, campus and local police departments must establish uniform reporting procedures to generate consistent data that will facilitate the identification of crash hot-spots.

Surveys

When conducting any sort of survey on a university campus, researchers must anticipate the need for approval from the Institutional Review Board (IRB). Approval from the IRB is necessary when conducting any sort of research involving human subjects (i.e., surveys). This is to ensure that the rights and welfare of human subjects are protected and the survey is in compliance with federal, state, and university regulations. Surveys that do not disclose any information that can be tied back to the respondents may be considered as "exempt" and not need to be reviewed by the entire IRB committee. However, time is still needed to review the application documentation and therefore researchers should consider and account for this in the overall project timeline.

Multi-Resolution Modeling

When researchers are considering modeling a university campus and the surrounding transportation system, several issues must be addressed ahead of time. Usually, a regional travel demand model can be obtained from local MPOs to determine projected future traffic conditions. However, researchers should know that travel demand models are static and cannot perform a temporal analysis of traffic at any given time slice (e.g., morning peak); therefore, a dynamic simulation model is needed. Regional travel demand models can be converted to mesoscopic Dynamic Traffic Assignment (DTA) models where traffic congestion can be analyzed at various time periods under different conditions. DTA models can reflect the changes in traffic patterns by rerouting vehicles based upon existing conditions or network changes. These types of models do not have the fidelity to perform detailed analysis of individual vehicle interactions or pedestrian-vehicle interactions and therefore micro-simulation is needed.

Microscopic models can simulate multiple modes of transportation simultaneously and can be used to analyze parking lot distribution, various types of traffic control for pedestrians, or speed reduction areas. Yet microscopic models are not large enough to capture the dynamics of traffic rerouting based upon regional changes (e.g., tolling on freeway redistributes traffic to and from the freeway). Researchers need to use multi-resolution modeling methods to capture both the system-wide and localized interactions in and around a university campus. However, there may be instances where the regional models do not have the inner university campus modeled, only the perimeter streets. In these types of situations, the microscopic models must be created from scratch, and origin-destination matrices should be created based upon data collection and surveys to determine campus entrance and parking.

REFERENCES

1. *Spaces, Places and People: A Comprehensive Study of the Needs of Students, Faculty, Staff, and Neighbors*, The University of Texas at El Paso, 2007.